

become a high-profile issue in China.

The latest five-year plan will launch efforts to protect the giant panda, tiger and Asian elephant in the wild, says Zhang Li, a conservation biologist at Beijing Normal University. “There will be a big budget to restore habitat for these species,” says Zhang. The projects will focus on corridors between protected areas that greatly increase habitats by letting the animals move from one reserve to another.

A biodiversity hotspot between Laos, Myanmar and the southwestern Chinese province of Yunnan requires protection in particular, says Stuart Pimm, a biodiversity specialist at Duke University in Durham, North Carolina. The forest there has been converted into rubber plantations, he says, “and the level of hunting is worse than any place I’ve ever been”. But a focus on protecting pandas, elephants and tigers could leave other animals at risk, he pointed out in November (B. V. Li and S. L. Pimm *Conserv. Biol.* 30, 329–339; 2016).

### STEM CELLS

In the wake of the five-year plan, China will gain a funding initiative called ‘Stem Cell and Translational Research’, according to stem-cell researchers Pei Gang, president of Tongji University in Shanghai, and Pei Duanqing, director of the Guangzhou Institutes of Biomedicine and Health. The stem-cell programme will be one of the first to award grants under a new competitive review and evaluation process, replacing a system that critics said rewarded scientific and political connections rather than merit. Following the previous five year plan, China invested roughly 3 billion yuan (about



Smog hits Beijing, a pollution black spot, on 25 December 2015 — for the fourth time that month.

US\$460 million) in stem-cell research.

The pair says that there will be a big increase over the next five years but did not give exact figures. “Given the size of its population and the wide spectrum of unmet medical needs, China recognizes the promise of stem-cell and regenerative medicine as one of the key thrusts for modernizing its medical-service system,” says Pei Gang.

### POLLUTION CONTROL

In a country that places great value on social harmony, air and water pollution are the trigger for an increasing number of protests.

Under a plan that began in 2012, the government is already trying to reduce the levels of airborne particulate matter measuring less than 2.5 micrometres across (PM<sub>2.5</sub>), which is small enough to penetrate deep into the respiratory system. By 2017, it wants to achieve reductions of 25% in the Beijing area, 20% in

the Yangtze River Delta and greater Shanghai area, and 15% in the Pearl River Delta. Major nationwide environmental initiatives outlined in the latest five-year plan will tackle transportation, clean energy and environmental protection, says Wei-xian Zhang, director of the State Key Lab for Pollution Control at Tongji University.

The government will also target pollution black spots, such as smog in Beijing and fertilizer pollution in Lake Tai near Shanghai. Funding to control air pollution alone will increase by at least four times, says Zhang, and several new national laboratories focusing on clean energy and environmental research have also been funded for the next five years. “China is and will continue to be the largest market in air-, soil- and water-pollution control technologies,” says Zhang. “To some degree, the whole country will be a huge laboratory for environmental research, such as smog mitigation.” ■

## CLIMATE

# China’s carbon emissions could peak sooner than forecast

*Five-year plan advances policy to reduce reliance on coal and expand renewable energy.*

BY JEFF TOLLEFSON

The world’s largest greenhouse-gas emitter is turning a corner on climate change. China’s 13th Five-Year Plan reinforces the country’s seismic shift away from dirty coal, and many specialists now think that Chinese emissions are already nearing their peak — well ahead of schedule.

Approved on 16 March, the plan sets out basic goals and requirements for energy use and the environment until 2020 — and establishes an overarching strategy for economic development, as well as some themes to shape the

direction of research (see opposite). In particular, the document strengthens mandatory targets put in place over the past decade to reduce energy use, curb air pollution and promote the development of wind, solar and nuclear power.

These efforts have begun to work: China’s coal consumption declined by an estimated 3.7% in 2015, according to statistics released in February by the Chinese government.

Such a decrease is unprecedented, says Barbara Finamore, Asia director for the Natural Resources Defense Council, an environmental-advocacy group headquartered in New York City. “I think it’s catching everyone by surprise.”

The new plan calls for an 18% reduction in carbon intensity, which is a measure of how much carbon dioxide is emitted per unit of gross domestic product. That is slightly stronger than the 17% target set in 2011. The latest plan also seeks to limit the country’s total energy use. China consumed energy equivalent to 4.3 billion tonnes of coal in 2015, and the plan would seek to cap that figure at the equivalent of 5 billion tonnes by 2020.

Nonetheless, the document does not specify how China will hit its targets. “The point of this is to set the tone and direction,” says Ranping Song, who handles climate ▶

► policy in developing countries for the World Resources Institute, an environmental think tank in Washington DC. Song expects China to release detailed plans in coming months about how various sectors of its economy will meet the new commitments.

But China is already on track to achieve — and probably exceed — its previous targets. The latest data suggest that the country may have already halted its dramatic rise in coal use, beating the 2020 deadline that it set 2 years ago. China also leads the world in the deployment of renewable energy, investing some US\$110 billion in 2015.

At the United Nations climate summit in Paris last year, China committed to halting growth in greenhouse-gas emissions by 2030, but consensus is building that a peak could come by 2025 — if not sooner. In addition to energy trends, the latest forecasts account for slower economic growth, as well as a shift away from heavy manufacturing and the production of steel and other commodities.

Some fear that coal consumption could spike again, along with carbon emissions, if China's slowing economy revives. But a London School of Economics study published on 16 March concludes that this is unlikely (F. Green and N.

Stern *Clim. Pol.* <http://doi.org/bdmm>; 2016). The Chinese government's latest energy data suggest that emissions may have dropped in 2015, says Fergus Green, a policy analyst who co-authored the study with economist Nicholas Stern. This means that China's emissions may have already peaked.

One big question is whether China can rein in oil use in the growing transportation sector, in which the government has been less aggressive. Nonetheless, Finamore says, strict new requirements on air pollution, driven by rising anger among Chinese citizens, are pushing China in the right direction. "This is the new normal." ■



A killer whale at SeaWorld, which has stopped breeding the animals in captivity.

## MAMMALOGY

# Clash over killer-whale captivity

*Lifespan of animals kept in parks is at centre of dispute.*

BY EWEN CALLAWAY

In a decision hailed by animal-rights groups, the US marine-park company SeaWorld Entertainment announced last week that it will no longer breed killer whales. But whether captivity harms the planet's biggest predator is an area of active scientific debate.

The latest arguments centre on two 2015 studies that drew dramatically different conclusions about the lifespans of captive killer

whales (*Orcinus orca*), relative to those of wild populations. Although many factors affect well-being, an apparent discrepancy between the survival of captive and wild animals has long been cited by activists as evidence of the poor welfare of captive killer whales.

One of the studies<sup>1</sup> is authored by a team largely made up of researchers at SeaWorld, which is headquartered in Orlando, Florida, and owns several animal parks that keep killer whales; the other<sup>2</sup> is by two former killer-whale

trainers at the company who feature in the 2013 documentary film *Blackfish*, which is critical of SeaWorld. In letters published last week<sup>3,4</sup>, authors from each paper accuse the others of cherry-picking data to support positions on whether the animals should be captive — charges that each team in turn rejects.

Although SeaWorld's captive-killer-whale programme now has an expiration date, the company's existing 23 animals will remain in parks for the rest of their lives, and its pregnant female Takara will give birth in captivity. Another 33 animals are held in other marine parks around the world.

Robust studies of killer whales' longevity are needed to improve the well-being of the remaining captive animals, says Douglas DeMaster, science director at the US National Oceanic and Atmospheric Administration's Alaska Fisheries Science Center in Seattle, Washington.

But the annals of research on captive killer whales are slim. Before 2015, the last major published study<sup>5</sup> dates to 1995, when US government scientists calculated that the annual survival rate of captive killer whales was several per cent lower than that of a wild population off the coast of Washington state called southern resident killer whales.

In one of the 2015 studies<sup>2</sup>, the former trainers — John Jett, a biologist at Stetson University in DeLand, Florida, and Jeffrey Ventre, a physician at Lakeview Campus Medical Facility in Yakima, Washington — attempted to measure how captive whales have fared since conditions were improved in the 1980s. They pooled data from between 1961 and 2013 on 201 captive killer whales in institutions around the world, including SeaWorld. They concluded that survival rates in captivity have improved since 1985, but that even the most recent survival rates are below those of animals in the wild.

In the other 2015 study<sup>1</sup>, researchers led by SeaWorld veterinary surgeon Todd Robeck came to a very different conclusion: that animals now in captivity at SeaWorld's US parks live just as long as wild populations. The researchers looked only at animals held at those parks after 2000, and produced a survival rate that is higher than a rate that they calculated for southern

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